The Institutionalization of Modeling & Simulation
or
Making M&S All It Can Be

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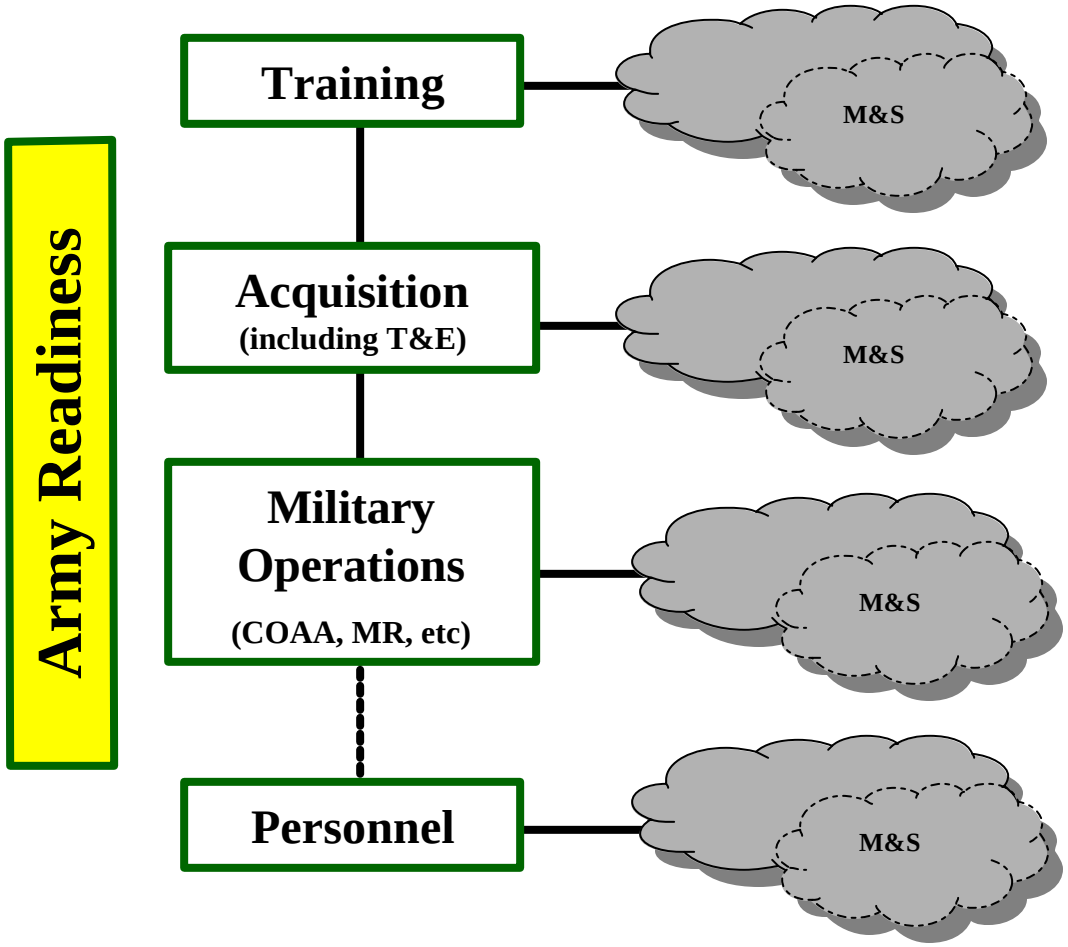
Why Simulation is Army Mission Critical



Good News

- Hundreds of examples of successful M&S applications exist
  - Range expansion via DBST
  - Application to T&E
  - JPSD, ACS
  - etc.

Challenges

- **State of the Art being pushed**
  - Lack 'best practices'
  - Technology immature
  - Modeling emerging military needs immature
  - Practices/policy immature
- **OJT trained workforce**
- **M&S Cost too much, too hard to use, too hard to understand results**
- **Duplication still an issue**

AMSO Strategic Goal

Institutionalize modeling and simulation within the Army. Make M&S effective and efficient so it is a viable tool for all – no matter what their job or mission

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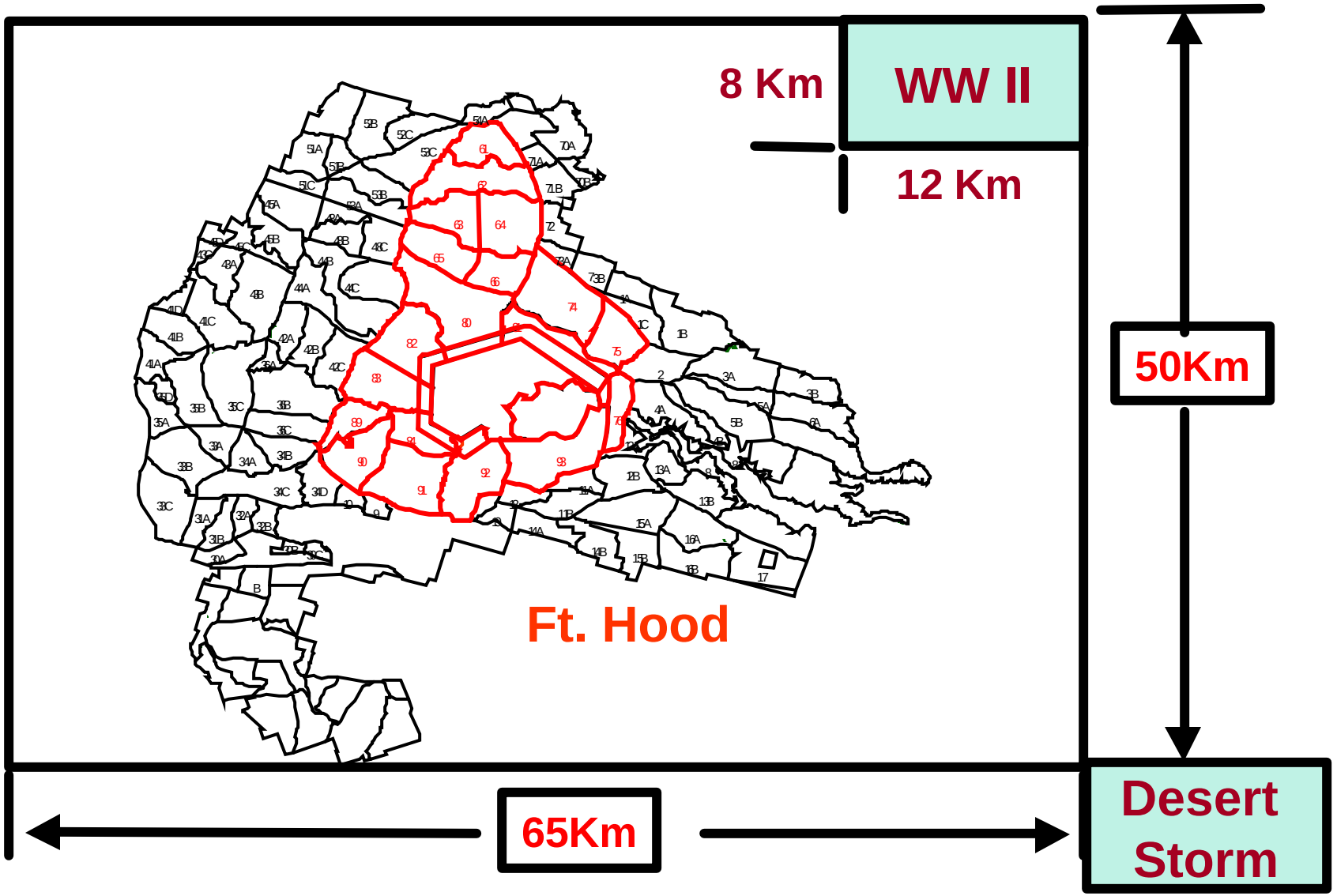
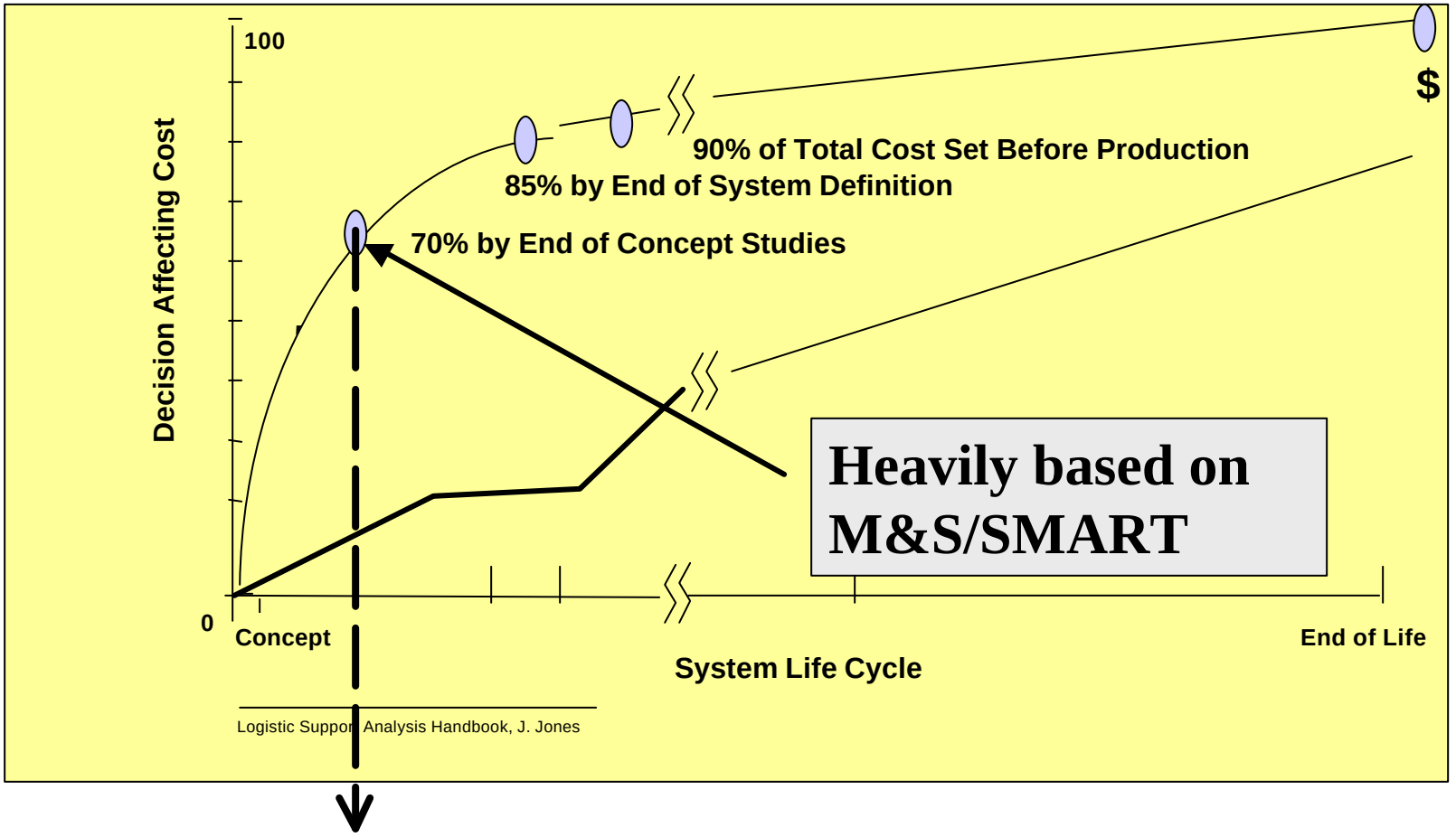


The Evolving Brigade Battlefield

Why Simulation is Army Mission Critical



FCS Milestone B: ~ May 2003

The Army and AMSO's Challenge

Provide a quality workforce, equipped with adequate technology, process and practices that support institutionalization of SMART/M&S within every aspect of the Army's mission space

- **Some challenges are technology**
  - Current ability to model emerging Army missions weak
  - Core Simulation technology still immature
  - Simulations cost too much, too hard to use, too hard to understand

Con't

The Army and AMSO's Challenge

- **Some challenges are policy, process and/or practice**
  - Everyone 'owns' M&S, thus no one does
  - Integration of M&S into the *requirements approval* process
  - Effective competition in the *budget/POM* process
  - Weeding out duplication
  - Not well coordinated across Services (i.e. Joint interoperability)
- **Some challenges are educating and enabling the workforce**
  - Workforce OJT trained
  - Limited formal and informal educational opportunities
  - M&S best practices still a mystery

We Need Community Wide Dialog on virtually every one of these subjects!

What is SMART?

SMART is a change in Army business practices, through the exploitation of emerging M&S and other information age technologies, to ensure collaboration and synchronization of effort across the total Army systems life cycle.

- **SMART is a concept, NOT a program**
- **SMART targets a change in Army business practices**
  - Implementation of SMART involves changes in processes across all three domains (ACR, RDA, TEMO)
- **SMART exploits M&S and related information age technologies**
  - Finally have an opportunity to make collaborative engineering work!
- **SMART is an enabler for successful Army Transformation**
  - It allows us to 'live' in the future our systems and people will live in
  - It provides a common 'language' for combat and material developers to communicate

Where We Are Today

Answer: SMART has the support of Army leadership at the highest level, it is integrated within the Army's Transformation Campaign Plan, and we are implementing it at all levels with both a push and a pull strategy. The Army is fully committed! **For Example:**

- **Future Combat System (FCS):** Pushing towards Milestone B with heavy reliance on SMART
  - Army Collaborative Environment **(ACE)**
  - Joint Virtual Battlespace **(JVB):** Is isn't a system, it's an architecture with at least one physical implementation in a system called….JVB
  - **RDEC Federation**: Bringing high resolution models into the JVB architecture
- **Policy, practices and products** slowly going into place to support a SMART based business practices

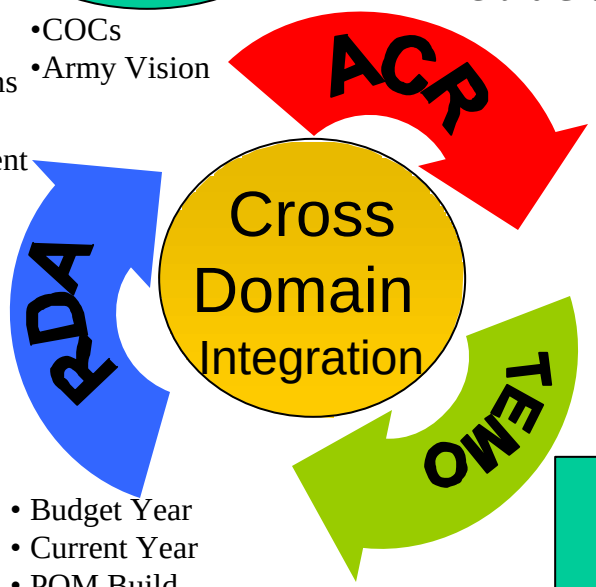
- **Clarification to the Answer above:** We all agree we are fully committed, we just don't all agree on what 'fully committed' means!

M&S Institutionalization: The Deep Battle

- **What is the M&S Deep Battle?**
  - Establish the 'business' of M&S
  - Establish the profession of M&S
  - Begin the shift of M&S practice from a craft to an scientific/engineering discipline

- **What are the deep battle components?**
  - Establishing the technology fundamental underpinnings
  - Maturing the body of knowledge
  - Professional development/education
  - Establishing best practices
  - Establishing a feeling and pride of community

Driving and Enabling the Change
AMSO Highlights for FY02



POLICY

- Draft Update/Integrate Army M&S Policy
- Simulation Spt. Plan Policy & Doc. Guidelines
- Army M&S S&T Plan
- Draft Update SMART Execution Plan
- Internal M&S Release

TECHNOLOGY

- M&S S&T Guidance
- Tech. Area Requirements Coord. & Prioritization
- FY02 AMIP/SIMTECH
- WTC/ASTWG
- Establish 6.1 R&D via Grand Challenges

REQUIREMENTS

- AROC
- Army Guidance Docs
- Army/DOD/M&S Master Plan
- SSP Review CONOPs

M&S VISION "CAPSTONE"

- COCs
- Army Vision

M&S BUSINESS PRACTICES

- Compendium of Algorithms
- M&S Community of Practice data base/Document

SUPPORT TO MAJOR ARMY M&S

- OneSAF
- JSIMS
- WARSIM
- JVB

SUPPORT TO TRANSFORMATION

- FCS M&S
- TCP
- OFTF

SMART

- SMART Conference
- Seminar Game
- SMART Education

COMMUNITY AND PROFESSIONAL DEVELOPMENT

- M&S Within Military Ed/Trng
- AMSO Website
- Displays/conferences
- Influence Academic programs
- Establish Science of Sims
- Informal Education

BUDGETS /POM

- Budget Year
- Current Year
- POM Build
- M&S "Comptroller"

SIM OPS PROPONENT

- Resident/Distance Learning Course
- Accessions & Assignments
- Force Structure
- ACS/TWI
- Civilian Program

Functional Areas of Interest

- T&E
- Scenario Generation
- Common SNE
- C4I IOP
- COAA

OTHER

- AMSEC
- External Coordination
- DMSO
- Sister Services
- M&S Community
- Academia
- International

EMERGING NEW MISSION AREAS

- Homeland Security/CT

Nothing Progresses without an Effective Business Model

- **What is a business model?**
  - A business model must express the methods/practices of doing business that allow all parties to be successful at meeting their end objectives.
- **What should an M&S business model contain? As a minimum, discussions about:**
  - Entities (people, organizations, products services, etc)
  - Methods (processes, practices, procedures)
  - Relationships (interactions, composition, collaboration, etc.)
- **What might a DoD/Army M&S business model try and drive?**
  - M&S Vision (Capstone Document)
  - **Alignment of Gov't and industry business models to allow effective movement of products, processes and people between the two**
  - **Use of Gov't influence to shape commercial sector, not to compete with it**
  - **Understand that Gov't and industry have different areas of expertise & drivers, focus accordingly**
  - Recognition that M&S will not mature unless, low cost, effective tools whose results are easy to obtain and understand are put in the hands of a skilled workforce
  - ***Marketing strategy!***

Establishing the Research Agenda and Technology Fundamentals

- **Grand Challenges in M&S**
- **In Search for the foundational underpinnings of M&S**
  - **Science of Simulation Workshop**
- **FAC Teams**
  - Coordinates related activates across the Army (MOUT, logistics, etc.)
- **M&S 2025 Vision**
  - **Requires community dialog**
  - Where do we want to be in 20 years?
  - What are the technology barriers?
- **Annual M&S updates to the Army S&T Master Plan**

Science of Simulation Workshop

- **Background:**

  All well established, professional disciplines have a set of characteristics that are the underpinnings of that discipline. One of these is a well defined set of fundamentals that establishes the foundation of research programs, day-to-day practice, education programs, etc. Modeling and Simulation is still in many ways in its infancy and has yet to establish/describe such a foundation, assuming it even exists. The premise however is that M&S cannot establish itself without beginning a process of attempting to define its core underlying technical foundations.

- **Objectives:**

  This workshop will be to seek the answers of the following questions:

  – Could there be a science of simulation?
  – What is our state of understanding that might contribute to such a science?
  – What do we need to do to improve that understanding?
  – What difference will a science of simulation make to the world?

The answers to these questions will help to guide those seeking to improve the ways we currently develop and use simulations.

Workshop was held on 4-6 June 2002. Final report will be available in the Sept/Oct timeframe. www.amso.army.mil/simscience

Grand Challenges in M&S

- **Why:** To provide energy to the M&S community and to help educate and influence S&T funding agencies by establishing a formally prepared set of M&S research areas

- **What:** We suggest that a Grand Challenge problem for M&S exhibits at least the following characteristics:
  - It is demonstrably hard, requiring one or more orders of magnitude improvement in current capabilities
  - It is solvable. Any problem that can be proven insoluble, e.g. describing a general solution to the Halting Problem, cannot be a Grand Challenge
  - The solution to a Grand Challenge problem must have significant social and/or economic impact
  -

- **How:** As a first step we have tried to initiate a community dialogue regarding Grand Challenge problems
  - Have initiated conference and workshop activities devoted to Grand Challenges
  - Hopefully the conference and workshop activities will in turn lead to the production of articles suitable for our leading scientific journals

- **When:** We hope to have the first set of peer formulated challenges published summer/fall 2003

Without a well-articulated, technically-defensible vision, the M&S community risks spending its time and effort solving irrelevant problems and/or tilting at windmills
www.grandchalleges.org

Focus Area Collaborative Teams (FACT)

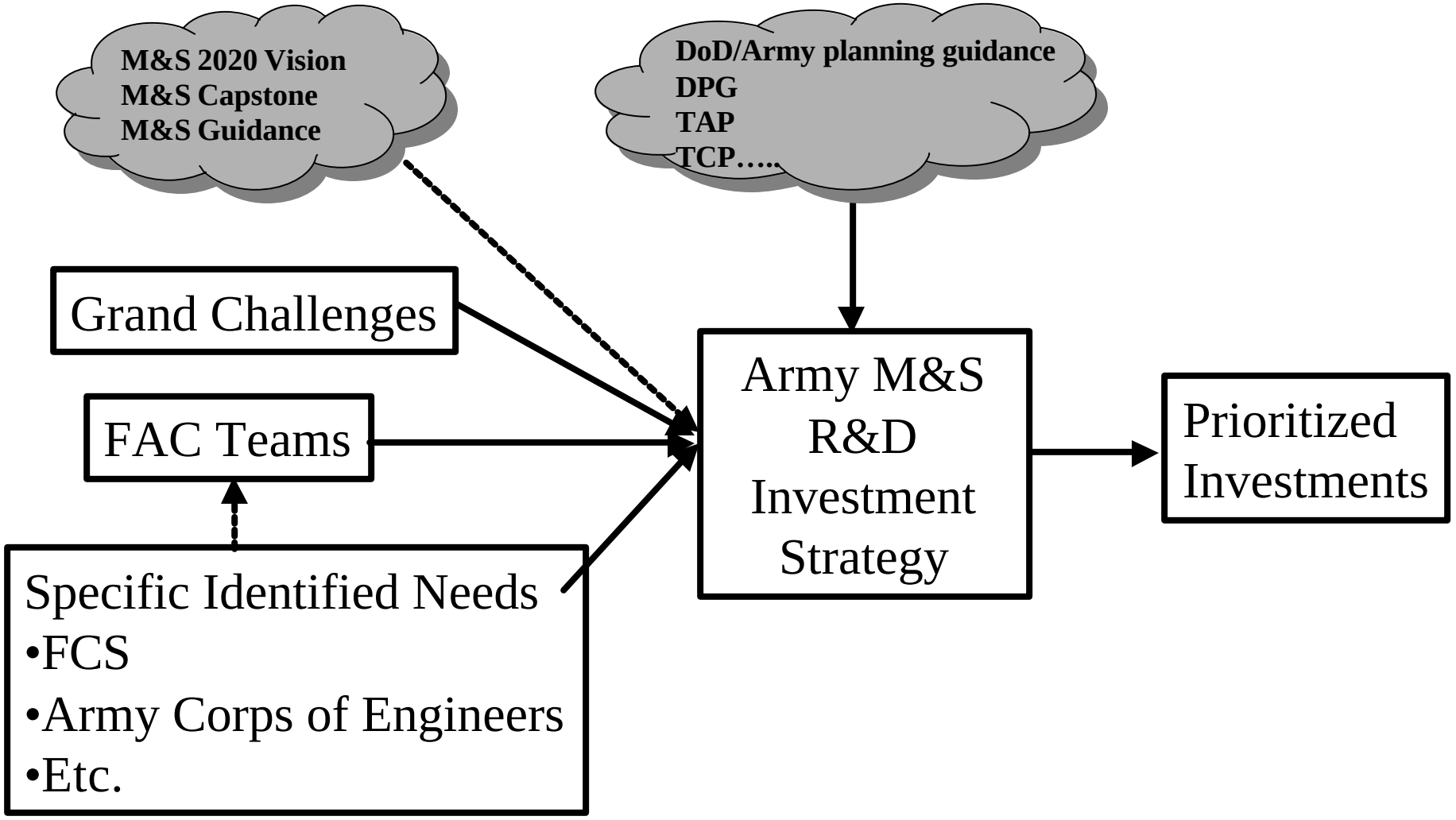
Designed as Army-wide focus groups used to research, identify and coordinate simulation technology projects in specific Army Transformation high-payoff areas. They emphasize the cross-domain collaborative teaming arrangements in developing an enterprise approach for model improvement in high payoff Army M&S areas with an emphasis from operational communities (6.2/6.3).

- **FAC Team products should be:**
  - Domain Vision
  - Analysis of current state of the art
  - Technology gap analysis; recommended set of technology initiative areas (to include a set of peer reviewed high priority/high payoff research proposals)
- **How the Army should utilize FACTs:**
  - Before any R&D project covered by a FACTis approved, it should be peer reviewed by the appropriate(s) FACT. The FACT should not be in the business of passing need valute judement, it should be in the business of identifing technology gaps and helping the Army to ensure proposed work is valid, relivant, coordinated with related work and is not duplicative in nature.

- **FAC Teams must be cross domain, made up of area experts and above all unbiased**

- **Current FACTs are:**
  - Environmental Data Bases
  - Military Operations in Urban Terrain
  - Space
  - Logistics
  - C4I to Simulation Interoperability

Guiding R&D Investments



Maturing the M&S Body of Knowledge

This is an area that is very poorly defined and 'managed', but is critical to long term success.

- **Increased emphasis on peer review publication**
  - Currently difficult to separate wheat from chaff in the literature
  - Peer publication brings a level of quality control to the process
  - Requires increased emphasis by R&D sponsors
- **Increased emphasis on quality of research plans:**
  - Critial need to establish something like the (Egyptian) Alexandria Library to improve our literature search capabilities
- **Higher quality lessons learned reporting/documentation**
  - Working with JFCOM and DMSO to 'peer review' MC02 results. The intent is to try and capture meaningful lessons/knowledge vice the usual 'wasn't this a great expenditure of taxpayers dollars' briefings
- **Establishing an M&S taxonomy**
  - You can't hold a meaningful conversation without a common understanding of the meaning of your words

Professional Education/Development

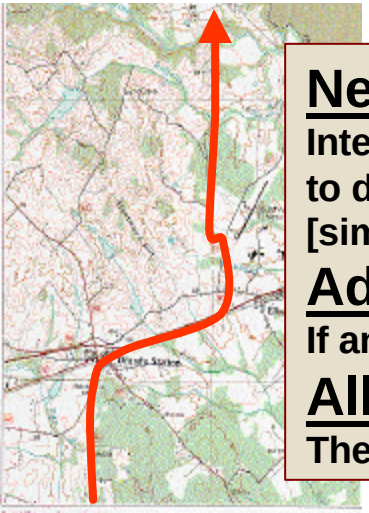
- **Computer-based M&S is emerging as a discipline with a wide variety of deep theoretical, methodological, and applied subject areas. The field unquestionable has widespread impact in society today, but:**
  - There is not a clear or generally accepted definition of what constitutes an M&S professional (required knowledge, skills, abilities and experience
  - The distinction 9if any) between M&S and other disciplines and professions is unclear. Is M&S a field unto itself or is it a subset of other fields?
- **M&S cannot mature without having a mature workforce. Some of the challenges today are:**
  - Jump-starting formal education. Does the pull from academia and the push from industry match to a point where this part of the business model works?
  - Creating a robust continuing education, informal education environment
  - Diversity of the educational need:
    - Simulationist as geeks and wire-heads
    - Program managers that build or apply simulation within their programs
    - Specialists such as systems engineers, T&E, logistics…..
    - Program support personnel such as budget analysis…..
    - Headquarters personnel such as senior decision makers, policy vendors….

The Three P's
Policy, Process, Practices

- **Army Policy: Currently reviewing major Army regulations for M&S content and consistency. Undergoing update:**
  - AR 5-11
  - AR 70-1; 71-2,
  - DA PAM 70-3
- **Process: Still maturing**
  - ORDs and supporting documentation staffed with AMSO prior to AROC
  - SSP (IAW TRADOC policy) part of AROC package
- **Practices: Still maturing**
  - M&S Best Practices
  - Include M&S in (Systems Engineering/Software) CMMI
  - Access to tools
    - MSRR
    - Working with DMSO to establish a COTS equivalent of MSRR

Simulation Support Plan

A Simulation Support Plan is a "roadmap" that lays out how M&S tools support overall development of a concept or a system. The SSP depicts the how and when M&S tools are integrated, utilized and transitioned in the course of concept exploration and system development. [SMART Guidelines]



New Development : [TRADOC Pam 71-9]

Integrated Concept Teams (ICT) are established to develop concepts, and requirements documentation… The ICT produces the initial [simulation support] plan for management of simulations...

Advanced Technology Demonstrations : [DA Pam 70-3]

If an ATD includes significant simulations/simulator support...a SSP must be developed...

All Systems: [DA Pam 70-3]

The PM articulates his M&S strategy via the Simulation Support Plan (SSP)…

Purpose of the SSP

- Catch duplication
- Identify investments in this area
- Adherence to best practices
- Identify models used as well as upgrades needed (esp. important if a Enterprise level model such as OneSAF must be upgraded)
- Identify adherence to approved standards (or to help identify places where new standards would be of use)
- Assist with cross domain coordination
- Allow for peer review/incorporation of lessons learned
- Ensure adequate VV&A
- Ensure effective use of Army SME (data/models)
- Ensure S&T (and other efforts) have data/model generation as part of their output

The Military M&S Professional (FA-57)

FA 57 Vision

"A trainer who is equally adept as an operator and simulationist. We have lots of folks, civilians as well as military, who can do the technical business, i.e. write code, program, design simulations networks and etc… few of them are operators who understand the capabilities simulations offer and know enough to help our future simulations environments... "

LTG Shinseki, 27 June 1997

CSA Approved 24 Jan 01

Army Civilian M&S Career Program

- **Issue:** With limited resources, transformation, and technology advancements, Modeling and Simulation Professionals have evolved to become a critical enabler supporting DoD and the Army.
  - GEN Shinseki stated that the lack of trained and ready simulation personnel is an Army strategic shortfall.

- **QUESTION:** How can we continue to effectively utilize, develop, train, and sustain enough M&S professionals to meet these requirements?
  - Establishing a new Career Program (CP) - Currently underway
  - Developing a new Job Series - 500 Meter Target

- **When:** If all goes well formal documentation will be presented late spring 2002, with approval by Fall 2002

1520			2				
1550		1	10	3	2	16	
1670			1			1	
1701	2	2	2	4		10	
1712			3	8	6	17	
1750				5		5	
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TOTAL	9	59	158	528	275	52	1081

Professional Development/Education Initiatives within the Army

- **Maturing of the Army's FA-57 course of study**
  - Six week institutional course recently updated, driving towards academic certification. Expansion to 16 weeks probable.
  - Conversion to an on-line distributed learning course is underway. Initial modules available Dec 2002; Will eventually be made available to the community at large.
  - Moving towards 10 students/year attending Advanced Civil Schooling (Masters degrees)
- **AMSO/ DMSO coordinating on 'PM Introduction to M&S' ADL course.** This is funded and underway

Professional development/education initiatives within the Army

- **Cradle to Grave Military Education**
  - Focus on M&S within curriculum content *and* M&S as curriculum support
  - Probable workshop this CY; output to set vector for next mini-POM inputs
- Work is progressing on establishing a **civilian CP program in M&S,** if all goes well we should be able to present to MR&A in early fall
  - Educational requirements for CP-57….not yet defined
- Exploring the idea of creating a **M&S leadership development program** with possible initial funding in FY03
- Potential CRADA to share lessons learned with formal and informal education providers

Establishing M&S Best Practices

- **Best Practices**:
  - Working with DMSO to create an **M&S best practices document**

State-of-the-art technical guidance for practitioners

- Surveys and case studies
- Developed by graduate students, FACTs (surveys) and line engineers (case studies)
- Published in academically-recognized journals and as texts

High-level guidance for PMs, etc.

- Basic what-for's and how-to's
- Developed by volunteers in the halls of DMSO, AMSO, etc.
- Published on websites

- **CMMI:** Working with DMSO to update the CMMI (the integrated software/systems engineering CMM) to include M&S practices

Establishing a feeling and pride of community

- **Question: What does it take to allow a Simulationist to be as proud of their career as a member of any other profession is of their chosen field?**
- Create a culture, feeling of community
- Documenting the history of M&S
- Professional certification: on the path to establishing recognized credentials?
- Establish a code of ethics
- Establishment of M&S as a recognized field of study and practice
- …..???

How do you explore the future, by going there and experiencing it or by consulting fortune tellers, tarot cards and crystal balls?